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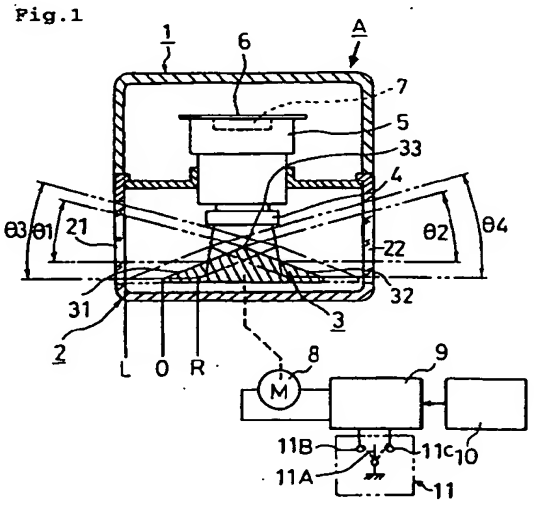
(54) Multi-direction camera

(57) A multi-direction camera is provided which can image road conditions of multiple directions in the same time and can image the road condition of one sole direction with a wider scope manually or automatically when the road condition of that direction needs to be confirmed preponderantly.

In the multi-direction camera A a mirror 3 having a plurality of reflecting surfaces 31 and 32 is disposed in front of a lens 4. The lens 4 receives light reflected from the mirror 3 from a plurality of directions and forms an image by the image sensor 7. The mirror 3 can be moved linearly by an actuator 8.

Fig.1



EP 0 772 078 A1

Description

FIELD OF THE INVENTION:

The present invention relates to a multi-direction camera for imaging multiple directions such as right and left directions of outside of a car and more particularly to an improvement of a multi-direction camera which can image multiple directions in the same time by one camera.

RELATED ARTS:

When one advances into an intersection by a car for example, it is necessary to confirm his/her safety by perceiving other vehicles regardless of whether a signal exists or not. However, it is difficult to see right and left road conditions especially when the sight of that section is bad.

Then, in order to solve such a problem, a multi-direction camera which allows to confirm the safety by imaging right and left road conditions by a camera provided at the front side of a car has been proposed as disclosed in Japanese Utility Model Laid-Open No. 1-109447 for example.

PROBLEM TO BE SOLVED BY THE INVENTION:

However, the prior art multi-direction camera described above has had a problem that although it can image road conditions of multiple directions such as right and left directions in the same time, it cannot image solely one road condition with a wide scope.

Accordingly, it is an object of the present invention to provide a multi-direction camera which can image road conditions of multiple directions in the same time and can image solely one road condition with a wider scope manually or automatically when one road condition needs to be confirmed preponderantly.

The aforementioned problem is solved by a multi-direction camera as described in claim 1.

According to the invention there is provided a multi-direction camera in which a mirror having a plurality of reflecting surfaces is disposed in front of a lens to receive light reflected from the mirror from a plurality of directions by a lens to form images on an image sensor, wherein the multi-direction camera is characterized in that the mirror is supported so as to be movable linearly.

According to the invention described in Claim 2, there is provided the multi-direction camera characterized in that the mirror is connected to an actuator so as to be movable linearly by the actuator.

According to the invention described in Claim 3, there is provided the multi-direction camera characterized in that one reflecting surface of the plurality of the reflecting surfaces of the mirror is set facing the left direction of a car and the other reflecting surface is set facing the right direction, respectively, and that the mirror is arranged so as to be movable linearly in the direction perpendicular to the light receiving direction of the lens.

According to the invention described in Claim 4, there is provided the multi-direction camera characterized in that the actuator is connected with a right/left turn signal generating circuit via controller and that the mirror is arranged so as to be movable linearly corresponding to a signal derived from the right/left turn signal generating signal.

The invention can be better understood when illustrated in a preferred embodiment.

A preferred embodiment of the present invention will now be explained with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a horizontal section view showing a main part of a preferred embodiment of a multi-direction camera of the present invention:

FIG. 2 is a top view of a car in which the unit shown in FIG. 1 is mounted;

FIG. 3 is an explanatory drawing showing an image formed on the surface of an image sensor shown in FIG. 1 when a moving position of the mirror is at a centered position O; and

FIG. 4 is an explanatory drawing showing an image formed on the surface of the image sensor shown in FIG. 1 when the moving position of the mirror is at position R in FIG. 1.

In FIG. 1, the reference numeral 1 denotes a case, 2 a cover, 3 a mirror, 4 a lens, 5 a lens mount, 6 a substrate, 7 an image sensor, and 8 an actuator. An arrangement of each will be explained below.

The case 1 is formed by an opaque member and is made up into a predetermined storage box in combination with the cover 2. A packing (not shown) is attached in a junction plane of the case 1 and the cover 2 to make up a water-tight structure.

The cover 2 is opaque except of right and left windows 21 and 22. It is formed by using appropriate means by inserting and forming the right and left windows 21 and 22 formed by transparent acrylic resin into an opaque member or painting in black the other part except of the right and left windows 21 and 22 after forming the cover 2 by transparent acrylic resin, for example.

The mirror 3 is triangular and the mirrored side surfaces thereof are formed by implementing aluminum vapor deposition on two reflecting surfaces 31 and 32 after forming it by synthetic resin. There exists a ridgeline 33 between those two reflecting surfaces 31 and 32.

The mirror 3 is mounted to an actuator 8 and can be moved linearly among positions L, O and R shown in FIG. 1 by operating the actuator 8. The

moving direction thereof is perpendicular to the light receiving direction of the lens 4.

The lens 4 collects light reflected by each of the reflecting surfaces 31 and 32 of the mirror 3 and a focus thereof is set on the surface of the image sensor 7 described later. The lens 4 is attached to the substrate 6, on which the image sensor 7 is mounted, by using the lens mount 5. It is noted that a filter (not shown) is provided within the lens mount 5 in order to block light of wavelength other than visible rays.

Other than the lens mount 5 for supporting the lens 4, a terminal (not shown) is attached to the substrate 6 to be able to electrically connect with an AV (audio visual) equipment (not shown) within the car compartment and a controller 9 described later. The substrate 6 is supported elastically by a vibration-proof rubber (not shown).

The image sensor 7 is a device for converting light imaged on the surface of the device into electrical image signals and a CCD sensor is used in the present embodiment.

The actuator 8 is constructed by a stepping motor or a solenoid and is connected mechanically with the mirror 3 via an appropriate gear or link mechanism.

A camera A constructed as described above is mounted at the forward section of a car B, e.g. near a bumper section thereof, as shown in FIG. 2, so that the light receiving direction of the lens 4 is set toward the rear side of the car B. The left side reflecting surface 31 faces the left direction of the car B and the right side reflecting surface 32 faces the right direction of the car B, respectively. When the light receiving direction of the lens 4 is set thus facing the rear side of the car B, the image formed on the surface of the image sensor 7 and the image displayed on the AV equipment turn out as images not inverted laterally, i.e., images just as seen by eyes, thus giving a superior visibility.

The camera A described above is connected to the controller 9. The controller processes signals input from a right/left turn signal generating circuit 10 and a manual switch 11 and controls the actuator 8 corresponding to each of the signals.

The right/left turn signal generating circuit 10 is composed of a turn signal switch and others. The manual switch 11 is a switch manipulated when a driver wants to change the moving position of the mirror 3 manually and is equipped with a moving contact 11A and fixed contacts 11B and 11C.

An operation of the embodiment will be explained below.

When the mirror 3 is moved to position O shown by a solid line in FIG. 1, a left image a from an angle θ1 on the left side and a right image b from an angle θ2 on the right side are formed with a rate of one-to-one approximately centering on a boundary line c as shown in FIG. 3.

Next, when the controller 9 inputs a signal indicating a left turn for example from the right/left turn signal generating circuit 10, or when a manipulation signal for the left direction is input from the manual switch 11, the controller 9 controls the actuator 8 to move the mirror 3 to the right side, i.e. to the side of position R shown by an imaginary line in FIG. 1. Thereby, a left image a from a left angle θ3 is formed with a wider scope as compared to the right image b on the surface of the image sensor 7 as shown in FIG. 4.

When the controller 9 inputs a signal indicating a right turn for example from the right/left turn signal generating circuit 10, or when a manipulation signal for the right direction is input from the manual switch 11, the controller 9 controls the actuator 8 to move the mirror 3 to the left side, i.e. to the side of position L shown by an imaginary line in FIG. 1. Thereby, a right image b from a left angle θ4 is formed with a wider scope as compared to the left image a on the surface of the image sensor 7.

Preferably the direction of linear movement of the mirror 3 is perpendicular to the optical axis of the combination of lens 4 and image sensor 7, which optical axis is preferably parallel to the longitudinal axis of the car B.

EFFECT OF THE INVENTION:

Because the present invention is constructed and has the effect as described above, it can image road conditions of multiple directions in the same time and can image the road condition of the sole direction with a wider scope manually or automatically when the road condition of that direction needs to be confirmed preponderantly.

DESCRIPTION OF REFERENCE NUMERALS:

A:	Camera
B:	Car
1:	Case
2:	Cover
21, 22:	Window
3:	Mirror
31, 32:	Reflecting Surface
33:	Ridgeline
4:	Lens
5:	Lens Mount
6:	Substrate
7:	Image Sensor (CCD)
8:	Actuator
9:	Controller
10:	Right/Left Turn Signal Generating Circuit
11:	Manual Switch

Claims

1. A multi-direction camera in which a mirror (3) having a plurality of reflecting surfaces (31) and (32) is disposed in front of a lens (4) to receive light reflected from the mirror from a plurality of directions by the lens (4) to form images on an image sensor (7),

said multi-direction camera being character-

ized in that said mirror (3) is supported so as to be movable linearly.

2. The multi-direction camera according to Claim 1, characterized in that said mirror (3) is connected to an actuator (8) so as to be movable linearly by said actuator (8).

3. The multi-direction camera according to Claim 2, characterized in that one reflecting surface (31) of said plurality of reflecting surfaces (31 and 32) of said mirror (3) is set facing the left direction of a car and the other reflecting surface (32) is set facing the right direction, respectively, and said mirror (3) is arranged so as to be movable linearly in the direction perpendicular to the light receiving direction of said lens (4).

4. The multi-direction camera according to Claim 2 or 3, characterized in that said actuator (8) is connected with a right/left turn signal generating circuit (10) via a controller (9) and that said mirror (3) is arranged so as to be movable linearly corresponding to a signal derived from said right/left turn signal generating signal (10).

Fig.1

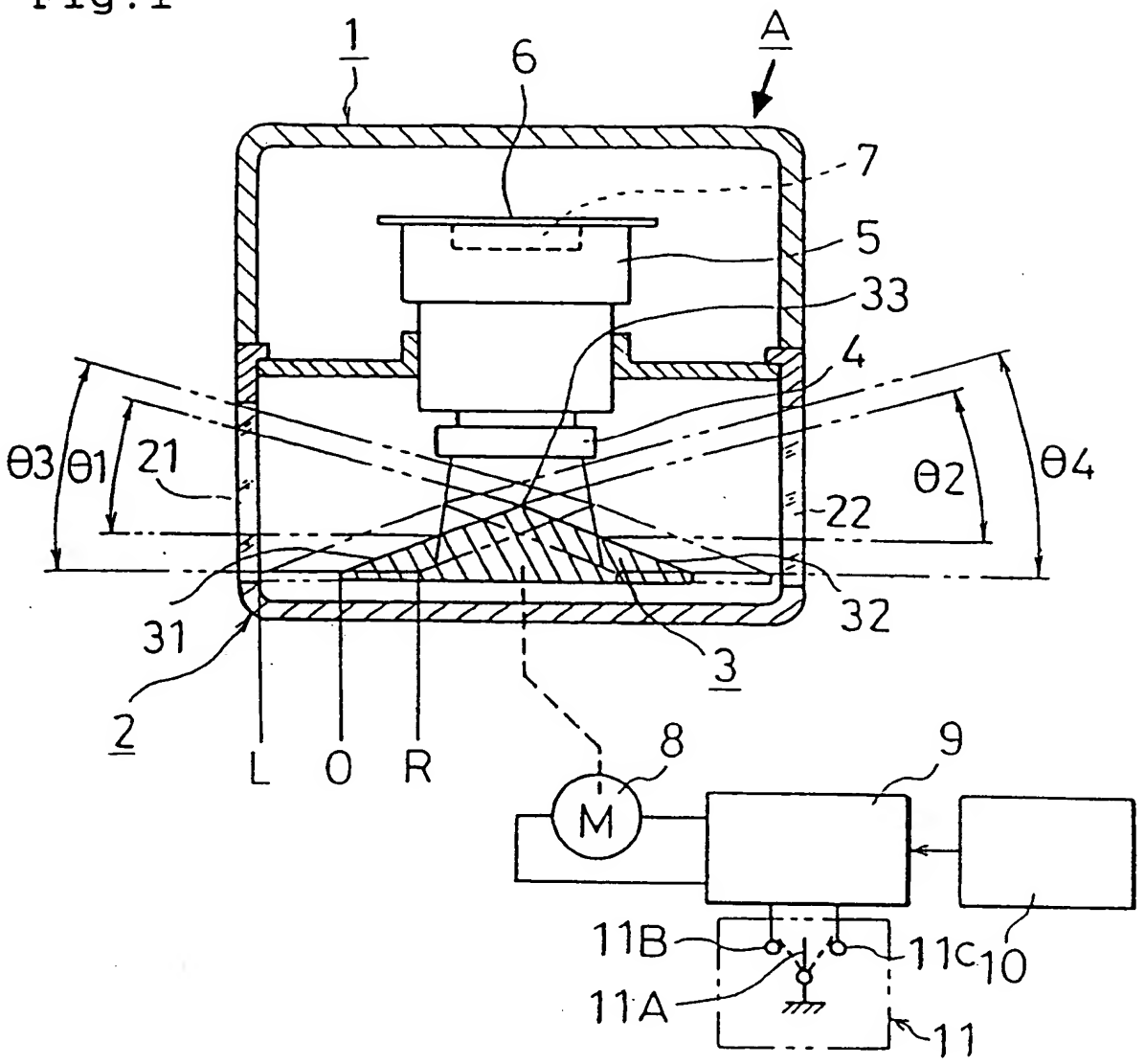

1
6
A
7
5
33
4
θ3
θ1
21
θ2
θ4
22
32
31
3
2
L
O
R
8
9
M
11B
11C
10
11A
11

Fig.2

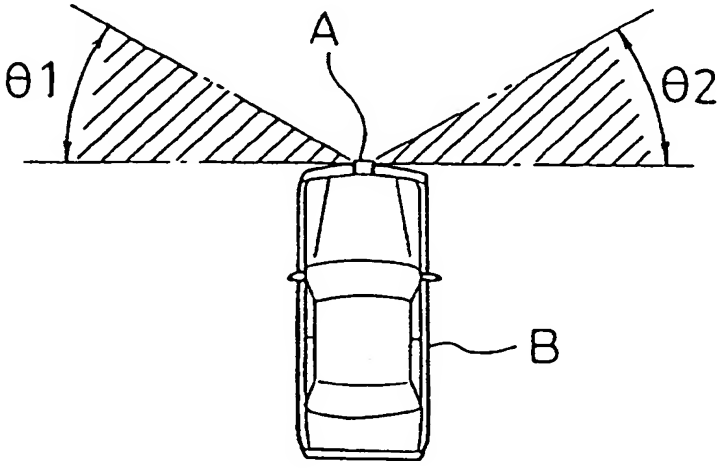

θ1
A
θ2
B

Fig.3

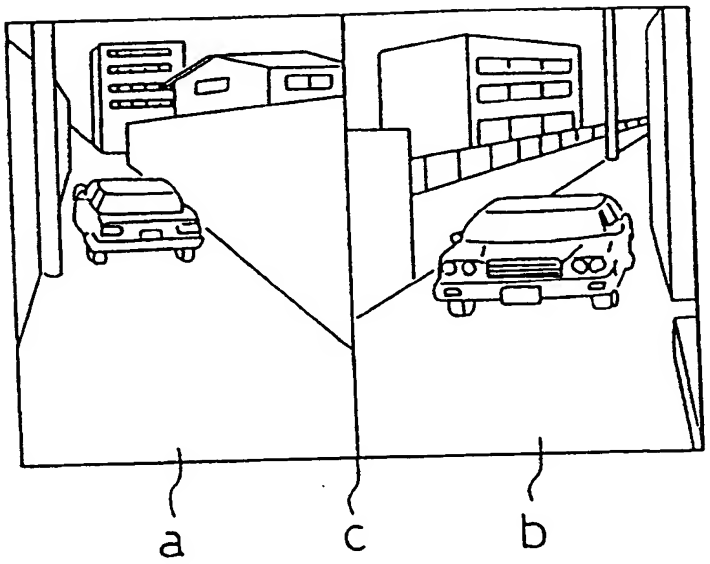
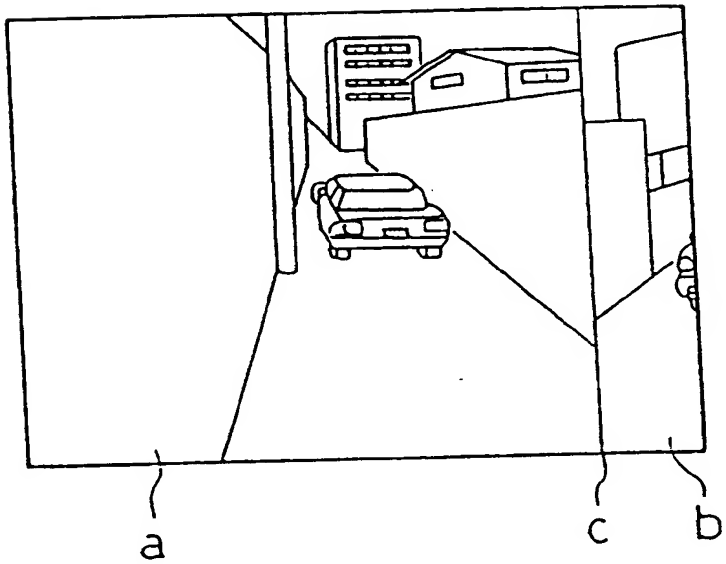


Fig.4



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EUROPEAN SEARCH REPORT

Application Number EP 96107981.1

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
Y	US - A - 4 326 218 (COUTTA) * Fig. 1-3,6,10; abstract; column 4, lines 33-61 *	1,2	G 03 B 37/00
A	--	3,4	
Y	US - A - 4 498 754 (OHNO) * Fig. 3,14,15 *	1-2	
A	--	3	
A	US - A - 5 414 461 (KISHI) * Fig. 1,3,7; abstract *	1-4	
A	-- DE - A - 3 744 623 (GEGGERLE) * Fig. 1; abstract; column 1, lines 39-45 *	1-2	
A	-- EP - A - 0 455 843 (OU) * Fig.; abstract *	1-3	TECHNICAL FIELDS SEARCHED (Int. Cl. 6)
A	-- WO - A - 93/21 736 (CROMWELL) * Fig.; abstract *	1-4	G 03 B 37/00 H 04 M 7/00 G 03 B 7/00 H 04 N 7/00 G 03 B 19/00 B 60 R 1/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	20-01-1997	KRAL

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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